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LA JUNTA, COLORADO. TECHNICAL ASSISTANCE PROJECT. SEPTEMBER 21-OCTOBER 4, 1970 AND OCTOBER 13-OCTOBER 19, 1970

Federal Water Quality Administration
Kansas City, Missouri

October 1970

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REPORT ON

LA JUNTA, COLORADO
TECHNICAL ASSISTANCE PROJECT

SEPTEMBER 21 – OCTOBER 4, 1970
AND
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ACKNOWLEDGEMENT

The success of the La Junta Project could never have been acheived without the enthusiastic participation by the City's personnel, not only through their willingness to buy the necessary equipment, but also through their dedication to doing the job right. The response and cooperation shown is gratefully acknowledged.

Appreciation is also expressed to Mr. Phillip Snyder, Supervisor of the La Junta Treatment Plant, for the extra hours and sincere personal dedication that he afforded the project.

Acknowledgement is given to the Colorado Department of Health for their support and assistance provided during the project.

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ABSTRACT

The Colorado Department of Health requested a assistance from the Federal Water Quality Administration to improve the overall operation of the La Junta Sewage Treatment Plant. This activated sludge plant was subjected to a heavy seasonal cannery load which increased the difficulty of operation.

The primary objective of the Federal Water Quality Administration assistance was to provide the operating and control methods to ensure that a high quality effluent was produced. This objective was met through a cooperative training and operating program in which plant personnel were exposed to testing procedures and equipment which led to a better understanding of the activated sludge process.

I. INTRODUCTION

On July 27, 1970 assistance was requested of the Missouri Basin Region of the Federal Water Quality Administration, to improve the operation of the wastewater treatment plant in La Junta, Colorado. This request was made by the Colorado Department of Health, Division of Water Pollution Control in cooperation with the City of La Junta. In response to this request a representative from FWQA visited La Junta and met with City, State, and County officials to determine the type and extent of assistance needed. It was determined that on-the-job training would be provided to La Junta plant personnel. Subsequently a work plan was developed for the La Junta Project outlining the following specific objectives:

1. Initiate a system of testing so that the plant processes can be more positively controlled.
2. Utilize the testing program results to improve the effluent quality.
3. Assist plant personnel in establishing the use of automatic equipment for plant control.
4. Provide a mode of operation that will adequately handle the seasonal loading from the cannery in La Junta.
5. Provide training to the plant operator on conducting the BOD test so that he can monitor the plant's performance.

To implement the plan FWQA assistance was provided in two phases. The first phase, from September 21 to October 4, 1970,

provided on site operational guidance and the second phase, from October 13-19, 1970, provided assistance in conducting necessary laboratory analysis and training in proper sampling techniques.

II. DESCRIPTION OF AREA

The City of La Junta, county seat of Otero County, Colorado is located in the Arkansas River Valley adjacent to substantial irrigated cropland. The valley is surrounded by rolling, semi-arid plains used as range land for cattle. The 1970 population of La Junta is 7,724 persons.

During World War II, an air base was established north of La Junta which was later sold to the city and now serves as the municipal airport. Part of the large air base is being developed as an industrial park. The major industry within the park is Nibco of Colorado, a manufacturer of copper fittings. All of the wastes from the airport and the industrial park are discharged to a lagoon system and do not enter the municipal sewer system.

Within the community of La Junta, several industries discharge to the city sewer system. The largest of these contributors is Western Canning Company, which processes pickles on a continuous basis and, on a seasonal basis, tomatoes. Another industrial contributor is the Colorado Packing Company which is a small meat packing plant operating on an intermittent basis. Other major water users include the junior and senior high schools, the hospital, several motels, and the Otero Junior College which is a two year community college with an estimated 1970 enrollment of 630 students.

III. WESTERN CANNING TREATMENT FACILITIES AND OPERATION

Western Canning Company has two large canning operations within its La Junta plant. The pickling operation is conducted on a year-round basis while the tomato processing operation is seasonal. The tomato processing season normally begins in August and ends in October. It is during the tomato canning season that the La Junta plant experiences its most difficult operational problems.

In an effort to reduce the strength of the waste going to the La Junta plant, Western Canning has completed several projects. A channel type settling basin to remove mud washed from the tomatoes has been installed. The basin is followed by a fine screen which removes additional solids from the waste. The effluent from the screens is then pumped to the city sewer by two pumps capable of increasing the La Junta Sewage treatment plant influent flow by 66% in fifteen minutes. Wastes from the pickle processing operation pass through a course screen and then directly to the city sewer.

The city has almost completed construction of a large basket screen on the discharge line from the cannery to finally screen the total cannery waste before it is discharged to the city's sewers. A flow-measuring device has been installed adjacent to the basket screen allowing the city to monitor the volume of waste discharged.

IV. LA JUNTA TREATMENT FACILITIES

A. Original Sewage Treatment Facilities

Figure 1 presents a schematic flow diagram of the La Junta Sewage Treatment Plant, as it was constructed in 1961. At that time the contact stabilization or "biosorption" process was being used. The following is a description of the major units:

1. Lift Station: The lift station is equipped with two 1,800 gpm pumps to transport the raw sewage to the plant.
2. Headworks Structure: The headworks structure consisted of a grit removal device, a Parshal measuring flume and a comminutor.
3. Combination Clarifier-Contact Unit: The 80 foot diameter final clarifier is divided into 2 sections. The 10,000 gallon contact tank portion used to aerate and mix the incoming raw sewage and the reaerated return sludge and the 304,000 gallon clarifier portion used to separate the solids from the liquid.
4. Reaeration or Stabilization Basin: This 314,000 gallon basin is equipped with six turbine type aerators. The basin was used to reaerate the settled sludge from the final clarifier before it was returned to the contact tank.
5. Digestors: There are two 50 foot diameter by 25' 9" side water depth heated digestor tanks with floating covers.

6. Sludge Drying Beds: There are approximately 24,300 square feet of beds which were used for drying the digested sludge.

7. Sludge Collector Basin: This unit was used to thicken the waste-activated sludge before it was removed to the digestors. The basin acted simply as a settling chamber for the waste-activated sludge.

B. Existing Treatment Facilities

The La Junta plant was modified in 1968. Figure 2 presents a schematic flow diagram of the plant after modifications were made. The major modifications are outlined below:

1. Lift Station and Headworks: The modifications provided for grit removal, grinding and flow measurement ahead of the lift station. The old lift station was renovated and new pumps were provided.

2. Primary Clarifier: A 130,000 gallon primary clarifier was installed ahead of the secondary treatment facilities.

3. Aeration Basin: A new 277,000 gallon aeration basin equipped with mechanical surface aerators was installed.

4. Chlorination Facilities: Chlorination facilities and a chlorine contact tank were installed.

In 1968 the original headworks were abandoned. In addition, the old stabilization basin and contact tank were to be used only during the canning season. The sludge drying beds were idled and the digested sludge was hauled to the city's sanitary landfill for final disposal.

FIGURE I

FLOW DIAGRAM OF ORIGINAL TREATMENT FACILITIES

(BUILT IN 1960–61)

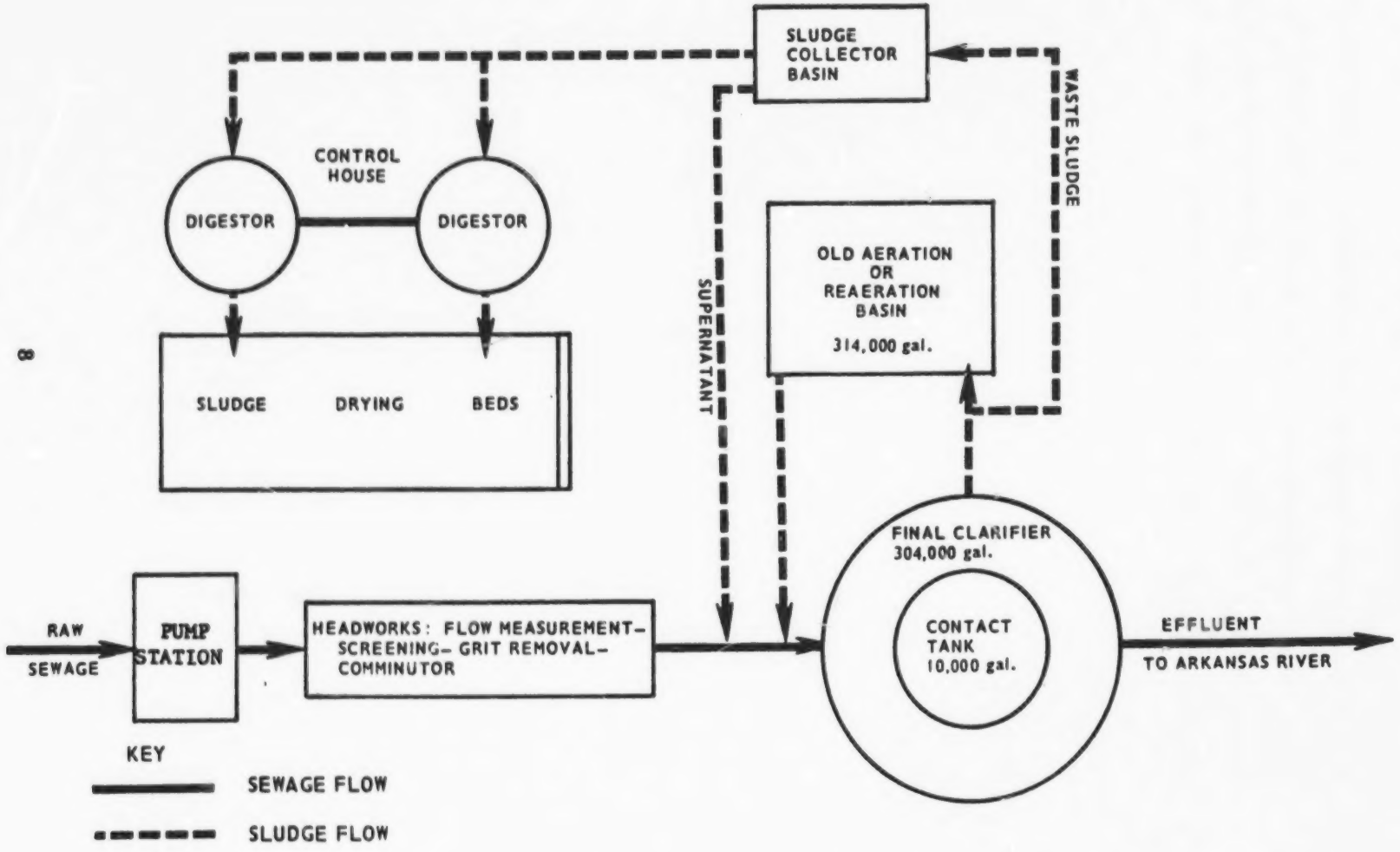
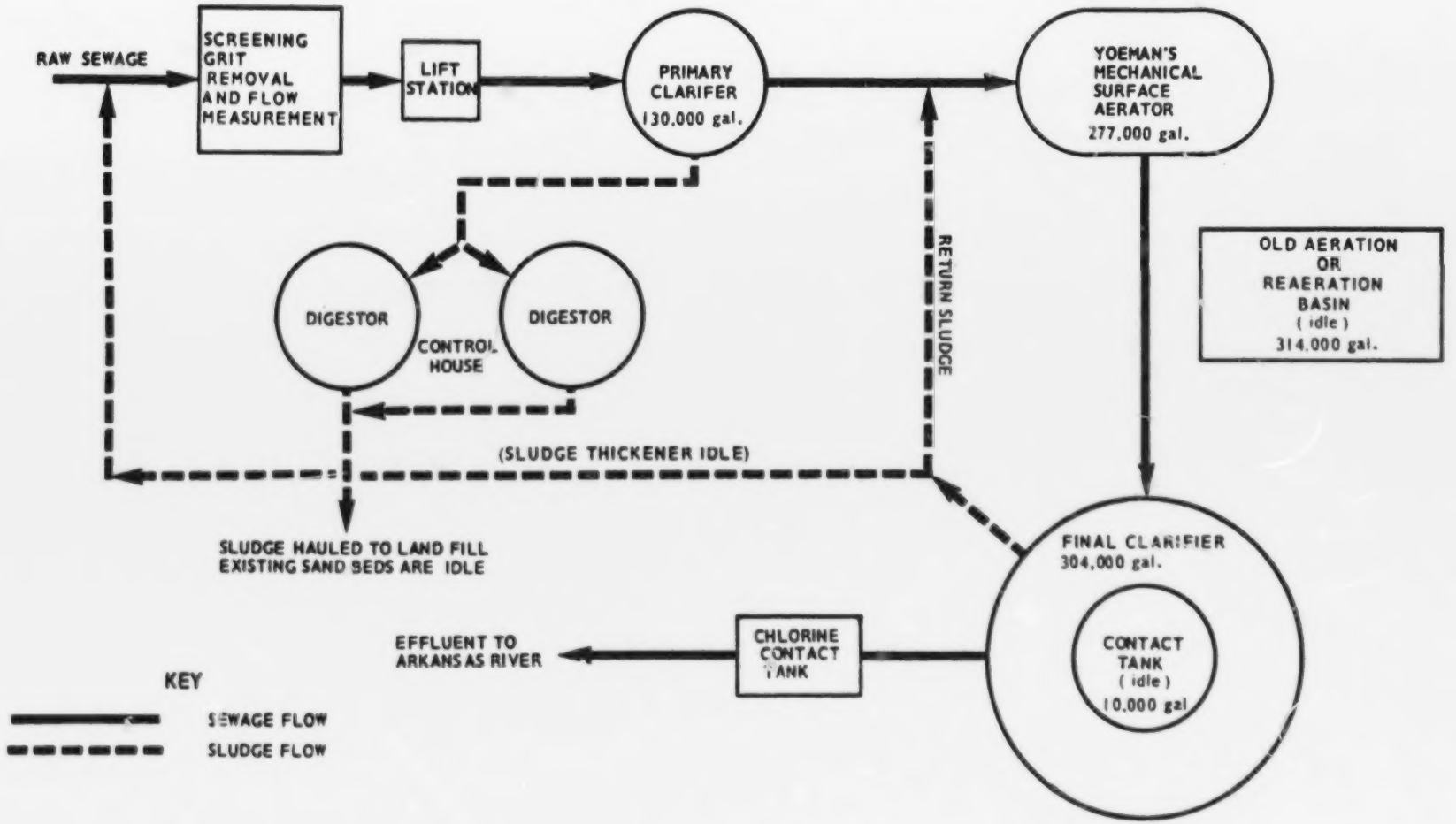


FIGURE 2

FLOW DIAGRAM OF EXISTING TREATMENT FACILITIES

(Modifications in 1968)



V. LA JUNTA PLANT OPERATION

A. Operation Prior to Technical Assistance

The plant was operated as a conventional activated sludge plant as shown on the flow diagram in Figure 2. The operational details, of major significance were:

1. Plant Operating Schedule

The La Junta plant was manned by a plant Superintendant and five plant operators. These six people were responsible for all of the sewers and sewer maintenance, the water wells, the sewage treatment plant and numerous other duties.

The sewage treatment plant was attended by the operators during the day Monday through Friday from 7:00 A.M. to 4:00 P.M. One man returned at about 8:00 P.M. each evening to check the pumps, etc. On Saturday only one man was on duty for the regular 8 hour shift and on Sunday no one was scheduled for a regular shift.

2. Primary Clarifier

The primary clarifier sludge was pumped twice daily to one of the two digestors. Automatic time clocks were available for the primary sludge pumps but these were not used. The sludge was pumped to a splitter box on the roof of the control house where it was directed to the desired digestor. If the digestor intake lines clogged, the sludge was free to run onto the roof of the control house. To avoid the possibility of pumping sludge on the roof when plant personnel were not available manual operation was necessary. The duration of the sludge pumping was determined by visual inspection.

3. Digestors

The digestors were both operated as unmixed primary digestors with digested sludge hauled to the city's sanitary landfill. Supernatant off the digestors was hauled to the sanitary landfill during the tomato canning season to reduce the waste load on the plant. The sandbeds are not used for the digested sludge because of the cost involved in hand cleaning them, as well as possible odor problems that might occur.

4. Old Aeration (Reaeration) Basin

The old aeration basin was idle at the time of the assistance project. The basin was operated with the new aeration basin during the 1969 tomato canning season, but results apparently did not justify its use during the 1970 season. Therefore, the plant superintendent decided to operate during tomato canning season without using both aeration basins. One of the problems in using the old aeration basin was the fact that the inlet piping was not valved to keep water out of the pipe. This piping had been wrapped with heavy insulation to avoid freezing in the winter when the tank was empty. Although unwrapping the pipe involved only a day's work it still was a deterrent to putting the old aeration basin into immediate operation.

5. New Aeration Basin

This basin was being used to handle all the waste entering the plant. Both surface aerators in the basin were turned on in the morning whereas only one of the aerators was utilized during the night to maintain dissolved oxygen. The solids content of

the basin was controlled by wasting sludge to maintain a 1,000 to 1,500 mg/l concentration based on a grab sample taken at about 8:00 A.M. Sewage and return sludge could be introduced at any one of three locations in this basin. These were the center of the tank between the two aerators or behind either one of the aerators. However all of the return sludge and sewage was introduced between the two aerators in the center of the basin.

6. Contact Tank

The old contact tank located in the center of the final clarifier was not in operation.

7. Final Clarifier

The large final clarifier had one weir around its circumference and was equipped with a surface skimmer. The sludge collection mechanism was of the scraper type. The weir and effluent trough were swept routinely to remove growths that accumulated. No sludge blanket measurements were taken but, when observations indicated the sludge blanket was close to the surface, the return sludge rate was increased in an attempt to pull the blanket down.

8. Sampling and Testing

Most samples taken at the plant were grab samples collected in the morning. Analyses performed included a settling test of the mixed liquor, total suspended solids, pH, volatile suspended solids and dissolved oxygen (YSI meter). No biochemical oxygen demand (BOD) tests or composite sampling techniques were performed.

Results of suspended solids analyses from

the morning grab samples indicated greater than 90 per cent reduction in the off-canning season.

9. Maintenance

Under the superintendent's direction an excellent maintenance program had been established and all of the personnel practiced preventive maintenance. All observed pumps, valves, etc. were in good working order. Even the equipment needed to operate the idle aeration basin was routinely started and serviced to assure that it was in good working order.

10. Activated Sludge Control

There are four basic parameters that can be controlled in the activated sludge process: the flow distribution to the aeration basins, the dissolved oxygen, the waste sludge rate, and the return sludge rate.

The La Junta plant had no control over flow distribution since they were using only one aeration basin.

Dissolved oxygen could be indirectly controlled by raising or lowering the effluent weirs. This increased or decreased the depth the paddles on the mechanical aerators were submerged, thereby affecting the volume of water agitated (i.e., the dissolved oxygen). No changes in the effluent weir settings had been made at La Junta. Other control over the dissolved oxygen concentration had been available by shutting off one of the surface aerators.

Activated sludge was wasted at La Junta by recirculating it to the head end of the plant so that it would settle and be removed with the primary sludge. The maximum wasting rate was

approximately 100 gpm. This rate could be reduced by a valve; however, resulting clogging problems had dictated that all wasting be carried out with the valve wide open. Wasting was used to control the mixed liquor suspended solids concentration at 1,000 to 1,500 mg/l based on the morning grab sample. To achieve this concentration, wasting was started at about 4:00 in the afternoon and continued until 7:00 the next morning.

The return rates of the activated sludge to the aeration basin were set at 650 gpm during the day and decreased to 450 gpm at night, with daytime rates increased slightly if it appeared that the sludge blanket was going to go over the effluent weir of the final clarifier. The maximum sludge return rate was 1200 gpm.

B. Operation After Technical Assistance

Technical assistance was provided by FWQA personnel in two phases. The plant operations or first phase was conducted during a portion of the tomato canning season from September 21, 1970 to October 4, 1970, and the laboratory control training or second phase was conducted from October 13, 1970 to October 19, 1970. In addition, an engineer from the Colorado Department of Health was at the La Junta Sewage Treatment Plant from September 29, 1970 to October 1, 1970 to observe progress.

During the first phase of the FWQA project, a system of control testing was initiated. The operators were trained to conduct dissolved oxygen, blanket depth, turbidity, sludge settling and centrifuge tests for plant control. During the second phase of

the project, training was provided concerning laboratory procedures, as well as proper sampling methods (such as compositing) to obtain reliable results. In order to illustrate the plant operational changes initiated during the FWQA assistance project, the portions of the La Junta Plant, outlined in A above, will be evaluated.

1. Plant Operating Schedule

Ideally a plant the size of La Junta's is operated on a 24 hour basis for seven days a week. This time schedule allows for control testing (i.e., sludge settling tests and centrifuge tests) in the morning, afternoon, and evening which gives the operator an indication of the process before the waste load enters the plant, during the load, and after the load. These three testing periods, when averaged, will give a fairly representative picture of the plants characteristics for that day. Control tests such as dissolved oxygen concentration, sludge blanket depth, chlorine residual, etc. should be conducted as frequently as every two hours when possible.

Activated sludge processes are sensitive to changes in loading and therefore, control parameters - return sludge flow, amount of sludge wasted, oxygen, etc. - must be continually adjusted to adapt the process to the waste load changes. Even Sunday's waste load which is normally much reduced from that received on week days requires adequate control and testing for proper treatment.

The control testing schedule at La Junta was established to fit the normal working schedule of plant personnel.

This involved conducting the major control tests, such as the sludge settling tests and the centrifuge tests, at 8:00 A.M. and at 1:00 P.M. Sunday control testing was practiced during the assistance project and was recommended for future operation.

It was estimated that one man will be required three to four hours a day, including Sunday, to conduct the control testing to operate the La Junta plant. This does not include maintenance, other laboratory analyses, composite sampling, yard work, etc. Additional plant personnel will be needed to meet these requirements.

2. Primary Clarifier

It is desirable to pump the sludge from a primary clarifier at frequent intervals for a short time rather than at long intervals for longer periods of time. This allows a more uniform loading to the digestors. The plant personnel at La Junta were aware that more frequent pumping is desirable but because of the limitations outlined in A-2 above, they hesitated to put the sludge pumps on time clocks during the night. It was recommended that a by-pass from the sludge splitter box on the roof of the control house be constructed so that if the sludge lines to the digestors became clogged, the sludge would be returned to the primary clarifier. With this arrangement the time clocks could be used without undue damage, if the lines clogged.

The duration of a sludge pumping interval was normally determined by a visual inspection of the "thickness" of the sludge. To eliminate any discrepancies in the determination of

the thickness of the sludge, the centrifuge was used to give a quantitative value to the "thickness." It is believed that once a by-pass is constructed a more beneficial sludge pumping schedule can be developed. This can be accomplished by utilizing the time clocks and the centrifuge test to set up more frequent pumping intervals of a satisfactory duration.

3. Digestors

The long-range plan, as outlined in the 1968 Engineering Report on the Municipal Sewer System; City of La Junta, Colorado prepared by McCall-Ellingson Consulting Engineers, calls for installation of the equipment needed to make one of La Junta's digestors a completely mixed, gas recirculation primary digestor. This would increase La Junta's sludge handling capacity with the existing facilities which are not used to capacity at the present time.

The city was hauling sludge supernatant and digested sludge to the sanitary landfill during the tomato canning season. It was proposed that a carefully controlled attempt at treating this supernatant in the activated sludge plant be made and the resulting effects on effluent quality and process control be determined. From this experiment a decision could be made on whether to continue hauling the supernatant or to try and treat it in the plant. This investigation was not undertaken during the canning season because of the heavy loads the plant was already experiencing.

4. Old Aeration (Reaeration) Basin

The inlet piping to the old aeration basin

should be modified so that the unit is available for use. This can be accomplished by modifications to the effluent gates on the primary clarifier. A sealed gate at this point would prevent water from entering the inlet piping and thus the wrapped insulation could be removed, making the aeration basin immediately available for use.

The old aeration basin is needed, along with the new aeration basin, to adequately treat the waste during the tomato canning season. Although difficulty was experienced the first year both aeration basins were used, these problems can be overcome by using the new control procedures. The old basin was not placed in operation during the FWQA assistance project because only about three weeks of the canning season remained whereas it would take approximately two weeks to build the needed solids in the basin.

It is noted that the old aeration basin is larger than the new basin. The old basin is a 314,000 gallon unit or 324,000 gallons, if the contact tank is included, while the new basin has a capacity of 277,000 gallons. The increased capacity of the old basin, as opposed to the new, may provide a more easily handled sludge that can facilitate more efficient removals. This possibility could be investigated by idling the new basin in the off canning season and experimenting with the operation of both basins during the 1971 tomato canning season.

5. New Aeration Basin

An effort was made throughout the FWQA assistance project to adequately control the dissolved oxygen (D.O.) content in the aeration basin. This was attempted by adjusting the

height of the effluent weirs. The D.O. content of the basin prior to the project had been 3-6 mg/l at the effluent of the tank. Weir heights at the effluent were lowered to decrease the effluent D.O. to a concentration of 2-3 mg/l. A disadvantage of lowering the effluent weirs was that it decreased the depth of the paddles in the mixed liquor. This reduces the D.O. concentration but also causes a reduction in the amount of mixing taking place in the tank.

Frequent D.O. measurements were taken and found necessary to adequately control the D.O. The policy of utilizing only one aerator during the night was continued, but it was decided to modify the procedure by introducing all sewage and return sludge at the gate behind the aerator that was operating. When both aerators were in operation the sewage and return sludge were introduced at the gate between them. The calculated detention time in the new basin ranged from 2.7 to 4.2 hours for the two-week period during Phase One of the assistance project.

The solids content of the aeration basin was maintained at 1500 to 2000 mg/l which was the highest level attainable with the type of sludge that existed at the time of the first phase of the project.

6. Contact Tank

The contact tank was not put into operation during the technical assistance project. However, it may prove necessary to use the contact tank in conjunction with the old aeration basin to obtain optimum performance during experimental evaluation of the old unit.

7. Final Clarifier

La Junta plant personnel constructed a sludge blanket finder which was used in control testing to evaluate the amount of solids in the final clarifier. The depth of the blanket taken at various times throughout the day was then used to determine how much of the activated sludge to waste.

The final clarifier, because of its large size in relation to the new aeration basin, turned out to be a reservoir for many of the activated sludge solids thus making it difficult to keep the activated sludge in the environment of the aerobic aeration basin. The size of the final clarifier is indicated by the long detention times (3 to 4.5 hours during study) and low overflow rates (150-310 gallons per day per square foot).

8. Sampling and Testing

During Phase One of the assistance project, a schedule for running a variety of control tests was established. No quality tests other than effluent turbidity were conducted during this phase. On Sunday, October 4, 1970, even though Western Canning was processing, the improved operation yielded an effluent turbidity of 3.3 Jackson Turbidity Units.

During Phase Two of the technical assistance project, La Junta plant personnel were trained to conduct various pertinent laboratory analyses. The major emphasis was on the dissolved oxygen and biochemical oxygen demand ($B.O.D._5$) test. Dissolved oxygen was determined in the laboratory using the Full Bottle Alkaline Iodide Azide Modification of the Winkler Method. This analysis proved

useful in standardizing the battery operated D.O. meter, which is used to determine the D.O. in the aeration basins. The B.O.D. test indicates the strength of the sewage by defining the amount of oxygen used by the putrescible matter under controlled incubation. This information together with the flow data is an essential basis for the design of treatment for a given sewage. When applied to the examination of effluents, it permits computation of the efficiency of operation of the treatment units and also indicates possible failures in treatment and the need for adjustments in operating procedures. Training on how to conduct the alkalinity test was also provided. Phase Two also included a review of the testing procedures that La Junta personnel were already using, such as total suspended solids, pH, volatile suspended solids, etc.

Another very important aspect of Phase Two of the La Junta project was training in proper sampling techniques which included composite sampling. Analyses were performed on composite and grab samples to demonstrate the erroneous conclusions that can be drawn from a single grab sample. To compensate for no operator being available at night, an attempt at using an automatic composite sampler was made. Some difficulty was experienced with clogging of these samplers. The final solution was to composite hourly for an eight-hour period on Wednesdays and Fridays. Results of the composite sample collected on October 14, 1970 showed an influent B.O.D. of 220 mg/l and an effluent B.O.D. of 13 mg/l, representing a B.O.D. reduction of 94%. The tomato canning season was over at this time.

9. Maintenance

As previously mentioned, La Junta has an excellent maintenance program and, as a result, no modifications or changes were recommended in the present program.

10. Activated Sludge Control

There are four basic parameters that can be controlled in the activated sludge process; the flow distribution, the dissolved oxygen, the return sludge rate, and the wasted sludge rate.

La Junta had no control over the flow distribution using only one aeration basin but when both basins are used, the rate of flow to each unit can be split as desired. An attempt should be made prior to the 1971 tomato canning season to determine the optimum division of the flow between the two basins.

The dissolved oxygen was being controlled, as outlined in B-5 above. The objective of this control was to maintain a 2-3 mg/l concentration of D.O. in the aeration basin effluent. La Junta was experiencing an over-aerated under-oxidized sludge. D. O. concentrations of 3-6 mg/l in the aeration basin were greater than desirable and the detention time (2.7-4.2 hours) and mixed liquor concentrations of 1000-1500 mg/l in the basin were less than desirable. This problem resulted from a combination of efficient aerators operating in a aeration tank too small to provide adequate detention time to the domestic plus the industrial waste flows.

The next basic control parameters in the activated sludge process are the return sludge flow and the wasted

sludge flow. Prior to the technical assistance project, wasting was utilized to control the concentrations of suspended solids in the aeration basin and the return rates were increased in the day and decreased at night to pre-determined flow rates. The operator had arrived at this operating mode by a series of trial and error adjustments. Although this practice was satisfactory in the off-canning season problems developed during the season since the sludge became more difficult to [illegible]le. La Junta was operating with a bulky sludge, that existed because of the over aerated under oxidized environment in the aeration basin. In the off-canning season the operator was able to operate with a bulky sludge because of the low overflow rates on the large final clarifier. However, during tomato canning season, the increased organic and hydraulic loads accentuated the uncontrollable features of the bulky sludge. The effluent produced by a slow-settling "young" sludge is generally of high quality with the disadvantage that it is difficult to control in such areas as wasting effectively, controlling bulking, controlling solids concentration in the aeration basin, handling increased or shock loads, etc.

The approach taken during the technical assistance project was to try and build a more stable better settling sludge that would be easy to control and to increase the solids concentration in the aerator to better handle the combined tomato canning normal domestic waste load. Difficulties were encountered in building a more stable sludge because of the relatively small aeration basin to large clarifier relationship which allowed many of the sludge

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solids (bacteria) to stay in the hostile clarifier environment plus the fact that canning season was in full operation and the plant was receiving its maximum waste load. To improve the characteristics of the sludge, it should be in the aerobic environment of the aerator the majority of the time. Therefore, to decrease the time the sludge was in the clarifier, the return rates were increased to almost maximum (1,200 gpm). The returns were decreased at night to about 800 gpm so that the return sludge rate could be increased proportionately with the incoming waste flows in the morning. The increase of the return rates were made about an hour after the morning flow started coming in to allow time for the sewage to pass through the primary clarifier. By increasing the returns with the flow, the solids concentration in the aeration basin can be maintained at a higher level than if the return is held constant. With a constant return, the increased flow of the incoming sewage in the morning has the effect of "pushing" the solids to the final clarifier.

It is anticipated that, as the sludge condition and loading characteristics change, the pattern of return sludge flow rates will have to change. The plant personnel were trained in making the various calculations and graphical aids necessary for selecting the proper settings for the return sludge flows.

It was also anticipated that a well-conditioned controllable sludge will be difficult to obtain with the relatively small aeration basin, large clarifier combination. For this reason, it was suggested that better results might be obtained if the old, larger aeration basin be used and maybe even the old

contact tank combined with the old basin. With this arrangement of larger aeration capacity coupled with the relatively large final clarifier, a stable sludge should be more easily developed. It is also noted that using both aeration basins would allow an even better arrangement and, as previously concluded both basins will have to be used during any future canning season.

The waste sludge flow rate was used to control the amount of sludge in the aerator clarifier system to the extent that bulking would not occur in the final clarifier. Since no satisfactory thickening devices are available at the La Junta plant and apparently no shortage of sludge handling capacity exists, it is concluded that the waste-activated sludge can most satisfactorily be handled by continued wasting to the primary clarifier.

solids (bacteria) to stay in the hostile clarifier environment plus the fact that canning season was in full operation and the plant was receiving its maximum waste load. To improve the characteristics of the sludge, it should be in the aerobic environment of the aerator the majority of the time. Therefore, to decrease the time the sludge was in the clarifier, the return rates were increased to almost maximum (1,200 gpm). The returns were decreased at night to about 800 gpm so that the return sludge rate could be increased proportionately with the incoming waste flows in the morning. The increase of the return rates were made about an hour after the morning flow started coming in to allow time for the sewage to pass through the primary clarifier. By increasing the returns with the flow, the solids concentration in the aeration basin can be maintained at a higher level than if the return is held constant. With a constant return, the increased flow of the incoming sewage in the morning has the effect of "pushing" the solids to the final clarifier.

It is anticipated that, as the sludge condition and loading characteristics change, the pattern of return sludge flow rates will have to change. The plant personnel were trained in making the various calculations and graphical aids necessary for selecting the proper settings for the return sludge flows.

It was also anticipated that a well-conditioned controllable sludge will be difficult to obtain with the relatively small aeration basin, large clarifier combination. For this reason, it was suggested that better results might be obtained if the old, larger aeration basin be used and maybe even the old

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VI. SUMMARY AND CONCLUSIONS

For the most part, objectives outlined for the La Junta Project were achieved. A system of control testing was initiated and plant personnel were trained to interpret test results so that adequate control over the activated sludge process could be maintained.

The control tests initiated at La Junta were used during the assistance project in an attempt to improve the plant effluent quality. It appears this goal was also achieved. Prior to the project, plant personnel had a relatively high quality effluent that they had obtained through diligent trial and error efforts; however, difficulty had been experienced in consistently controlling the sludge during the tomato canning season. Toward the end of the assistance project sludge characteristics were successfully altered such that it was more amenable to control. Although the average effluent quality was not improved markedly, improved plant control provided a more consistently reliable effluent.

Another objective of the project was to assist plant personnel in establishing the use of available automatic equipment for plant control. The timers on the plant primary sludge pumps were readied for use and a program was outlined for plant personnel to determine the most beneficial operating schedules for the sludge pumps. Actual use of the time clocks during the project was not initiated because of the physical plant limitations. Minor plant modifications can be made and were suggested so that a scheduled sludge pumping program could be initiated.

Additional time clocks are located on the two surface aerators in the new aeration basin. These were used to alternate the aerators on or off during the night when only one aerator was in operation. However, the influent gates could not be operated automatically and, when the aerators alternated, the influent would continue to enter the aerator at the same predetermined location. Consequently, some short circuiting occurred. To avoid this problem, the time clock operation was abandoned and one aerator was operated continuously with the sewage and return sludge introduced at the proper inlet for that aerator.

An adequate mode of operation to handle the seasonal loading from the cannery in La Junta will require the use of both available aeration basins. Both basins, coupled with improved operational control measures, should be more than adequate in the 1971 season if the proper preparation is accomplished prior to receiving the canning load. It will be necessary to make an arrangement with Western Canning stipulating that they notify plant personnel at least two weeks in advance of the start of their tomato canning operations.

The objective of training the plant operator in conducting the B.O.D. test was accomplished. In addition, training in other laboratory procedures was provided and comments on existing laboratory analyses were made. Improved sampling methods were demonstrated and a composite sampling program to be conducted on Wednesdays and Fridays was initiated.

VII. RECOMMENDATIONS

The results of both phases of the La Junta Technical Assistance Project led to the following recommendations:

1. The control testing and operational procedures initiated during the first phase of the project should be continued.

2. The laboratory analyses and sampling techniques established in the second phase of the project should be continued.

3. Modification should be made to the sludge splitter box such that the sludge pumps may be operated on a time clock basis. Using these clocks to activate the pumps in the absence of plant personnel will provide a more uniform sludge loading to the digestors and more efficient waste reductions by the primary clarifier. A suggestion for the modification would be to build a sludge by-pass line from the splitter box back to the primary clarifier.

4. A testing program should be established to determine the optimum frequency and duration of the sludge pumping from the primary clarifier. Twenty-four hour testing would be necessary to determine the frequency of pumping, whereas the centrifuge could be used to measure the "thickness" of the sludge to establish the duration of a pumping interval. In addition to this testing, influent and effluent composites should be collected to determine the efficiency of reduction of solids and B.O.D. The results of the composite testing would indicate the operational mode where maximum reductions occur.

5. Modifications should be made to valve the primary effluent from the inlet piping to the old aeration basin. This would

eliminate the need for the insulation wrapping around the inlet piping thereby making the old basin immediately available for use.

6. A controlled testing program should be initiated to compare the performance of the two aeration basins during the off-canning season. Using the recommended control testing coupled with composite sampling of influents and effluents, a performance comparison could be made to establish the operational mode that will give optimum reductions during the off-canning season. This will serve a dual purpose in also training the plant personnel in the operational characteristics of both aeration basins, which will prove useful during the tomato canning season.

7. Both aeration basins must be operated to insure a consistently high quality effluent during the tomato canning season. To insure time for both basins to be brought to an adequate operating condition, it will be necessary for Western Canning to notify plant personnel at least two weeks prior to beginning their tomato canning operations.

8. An operator should be present at the La Junta Plant on Sundays to insure continuous, positive control over the activated sludge process.

9. Additional personnel should be hired to insure adequate time for implementing the operational and testing programs as outlined in these recommendations.

10. An effort should be made to provide a more uniform flow from Western Canning. The present pumps at Western Canning are capable of increasing the flow to the La Junta plant by 66 per cent in

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10. An effort should be made to provide a more uniform flow from Western Canning. The present pumps at Western Canning are capable of increasing the flow to the La Junta plant by 66 per cent in

a matter of fifteen minutes. Many times these surges are of short duration. A small pump and larger holding basins would provide a lower, more consistent flow which would be more desirable.

11. The control testing procedures and calculations will generally provide adequate direction as to control adjustments; however several general control measures can be recommended.

The return rates should be increased in increments proportional to the load in the morning. These increases in sludge return should lag the flow increases an hour or so to allow for the time required for the flow to pass through the primary clarifier. In addition, when only one aeration basin is used, it may be necessary to maintain relatively high return rates in order to keep the solids in the environment of the basin, since the volume of the final clarifier is large in relation to the volume of the individual aeration basins.

The dissolved oxygen concentration should be monitored routinely and adjustments should be made to maintain a concentration of 2 to 3 mg/l at the effluent of the aeration basins. Dissolved oxygen adjustments with the new aeration basin will involve changing the elevation of the effluent weirs, whereas the adjustments in the old basin will involve changing the amount of compressed air going to the unit.

12. An attempt should be made to treat the supernatant liquor off the digestors under a controlled testing program. At the conclusions of the testing program the advantages and disadvantages should be weighed and a decision made as to whether to continue to

haul the supernatant to La Junta's landfill or treat it in the plant on a routine basis. The advantages or disadvantages should include an evaluation of the effluent degradation caused by including the supernatant, the cost of hauling to the landfill, etc.